

SAW TABLE OR TABLE SAW?

Ed Barton lost the use of four fingers on his left hand while using a portable circular saw which he had mounted on a table purchased and assembled by him. The story is told by Mike Faber, a professional engineer, retained as an expert witness by Bob Stratton, Ed Barton's attorney.

C. O. SMITH

My phone rang. Upon answering, I heard: "Mike? This is Bob Stratton.* [I had worked as an expert witness on several cases for Bob.] I have a client who lost the fingers on his left hand when using a table on which he had mounted a portable circular saw. I'd like to have you come in, hear the story, look at the device and tell me what you think. As before, you tell me whether or not you think there is a case from the technical side."

"Fine, how about two days from now, say at 10 in the morning?"

"Sounds good. I'll be looking for you."

When I met with Bob, he told me that his client, Ed Barton, had been shopping with his wife and mother-in-law. His mother-in-law knew that he enjoyed "do-it-yourself" projects. When she saw a saw table for sale, she thought he might like it as a Christmas present. She asked him and he told her he would like it very much. This table came in knockdown condition in a carton. After purchasing the table and taking it home, Ed opened the carton and found all the pieces and an owner's manual which had assembly and operating instructions. Although the carton was labeled as a saw table, it was obvious from the owner's manual that the manufacturer had intended this table to be light, portable, foldable for storage, and for use with a portable circular saw, router, or sabre saw. None of these three power tools came with the table but were to be supplied by the user.

Ed Barton read the complete manual twice to be sure that he knew how to assemble the table properly. Although Ed seemed to be a pleasant, responsible individual about 40 years old, he had limited reading ability since he had dropped out of school after the ninth grade. He and his wife had four children ranging in age from about 20 to 5. Ed had worked for several years for a large manufacturing company running a power press, or similar work, but at the time of his injury (about 6 months after buying the table) he was on "layoff" with several hundred other employees despite a good working record.

After reading the manual carefully, Ed had assembled the table and had mounted a circular saw, which he already had, on the table. He tried it to be sure that it worked OK. Although he was pleased to have it, he didn't really use it until about 6 months after purchase and assembly when he started to remodel his garage to make it an integral addition to his house. He had worked on the project one Saturday with no problem and was working on the project the following Saturday when he was injured. Ed told Bob that he had probably used the saw table with the portable circular saw mounted on it for a total of about 6 to 8 hours. All four fingers on his left hand were severed. He got to a hospital quickly and a doctor was able to reattach his fingers. About two and a half years later, when he had gone to see Bob, Ed was still not able to effectively use more than the thumb and palm of his left hand. He had been called back to work at one point, had tried it, and became convinced that he was not capable of holding that job. There had been discussion of retraining for clerical/office work, he had had some discussion with a psychologist, but retraining attempts had not been successful.

Ed's story was that he was ripping a piece of plywood [3/4 in. (190 mm

*All names, but no facts, have been changed

thick] which was about 3 1/2 in. (890 mm) wide and 41 in. (1.04 m) long. (Exhibit A-1). He had cut about a foot (0.30 m) when the piece "kicked back." He stopped the saw and checked to be sure that everything was proper and that the blade and ripping fence were parallel. On a second try, he cut about another 6 in. (0.15 m) and had the same experience. He repeated the check on the equipment. He tried a third cut and went about another 6 in. (0.15 m) or a total of about 2 ft. (0.60 m) when he again experienced a kickback. He attempted to raise the guard slightly by pushing up and to the right with the heel of his left hand. At that point, the guard and splitter came off, his hand dropped onto the rotating saw blade making contact at the junction between his fingers and palm.

Bob also told me that later, on searching the area around the table, two bolts (#10-24) and one nut were found. I told Bob that it was an interesting story, but as he knew, I would have to have more specific information.

He was well aware of that. He gave me an owner's manual but made it clear that it was not the one which came with the table. After Ed had assembled the table, he had put the manual in the carton in which the table came. A few days later, his wife threw out the carton. Bob did say, however, that it was his understanding that there was really little difference between the one which he gave me and the one which came with the table. [Much later in the discovery process, an owner's manual alleged to be the same as the original was made available. It was true there was little difference.]

Bob also said that the saw table, with the circular saw, was in his branch office in a town about 25 miles distant. Bob wanted me to go there and examine the table. Then, after I had time to go over the manual and saw thoroughly, he wanted a report which would focus on two items: (1) its suitability for the intended purpose and (2) the credibility of Ed Barton's story. Bob also commented that the circular saw might not be properly mounted on the table. Bob said he had been told that after Ed's injury, the boyfriend of his oldest daughter had taken the saw off, cleaned it thoroughly and then put the saw back on the table.

It seemed to me that I had a pretty good picture of what had been reported as the circumstances of accident and injury. It was entirely possible that I would have more questions after examining the table and manual, but I could readily get back to Bob on the phone, or in person, if necessary. After some chitchat, irrelevant to Ed Barton's case, I left Bob's office and drove to his branch office.

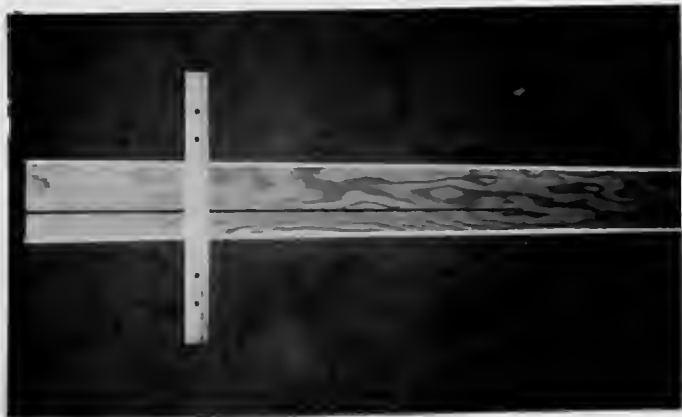


Exhibit A-1

Piece of plywood being ripped by Ed Barton when he was injured. A one foot scale is shown for size comparison.

SAW TABLE OR TABLE SAW? PART B

I spent a few hours at Bob's branch office, examining the saw table, comparing it with the owner's manual which he had given me, and taking some pictures. I even turned on the power and let it run a few times although I did not try to cut anything with it. After collecting all the data which appeared pertinent, I returned to my office. Later, I reviewed all the information which I had and wrote the following report to Bob.

RE: Barton Vs Hopper Company

Dear Mr. Stratton:

OBSERVATIONS

The saw table which Mr. Barton assembled and was using is shown in Figs. 1, 2, and 3. The table was sold in "knockdown" condition with a set of assembly instructions in an owner's manual. The first page of this manual gave the following specifications:

- Large 20" x 27" x 3/4" fiberboard work surface.
- Rugged baked enamel steel legs and cross braces.
- Heavy-duty electrical switch box, for precise control, plug your power tool into switch box.
- Heavy-duty mounting clips attach circular saw, router, or sabre saw to sturdy steel mounting plate.
- Quick mounting and removal of circular saw, router, or sabre saw.
- Adjustable degree miter gauge for accurate angles and cross cuts.
- Sturdy rip fence has aluminum edging for smooth sliding of work piece, reversible to use with router.
- High impact-see thru plastic blade guard.
- Exclusive safety shut-off bar.
- Folds compactly for easy storage.

The table used by Mr. Barton is shown in Fig. 3 but without a circular saw. My examination shows that Mr. Barton had assembled the table in conformance with the instructions in the owner's manual. In general, the table conforms to the specifications cited above. There are, however, a number of aspects of the design which raise questions. For example, the "exclusive safety shut-off bar" was intended to be across the front of the table as evident in Fig. 3. When this bar is pressed downward or pushed with the thigh or hip, it presses against a switch and shuts off the power tool. The switch box is plugged into an electrical power source and the power tool is plugged into the switch box. This necessitates that the trigger switch on the power tool be "permanently" in the ON condition. The owner's manual makes reference to installation of a "trigger lock" but none was supplied. Mr. Barton improvised by securely wrapping electrician's tape around the saw switch.

The top of the table was indeed a fiberboard of the specified dimensions [27 in. (68.6 cm) side-to-side]. As noted in Fig. 3, there are two slots cut for a miter gage when cross cutting. It was observed, however, that the table top is not flat. As seen in Fig. 4, there is a separation between the table top and a level, a separation of about 3/16 in. (48 mm) over a 24 in. (61 cm) span.

The ripping fence [23 in. (58.4 cm) long, 3 in. (7.6 cm) wide, 3/4 in. (1.9 cm) thick] is made from fiberboard and has an extruded aluminum T-section forced into a slot along the length of the fence. The working edge of the fence, however, is not straight. There is a separation of about 3/64 in. (12 mm) between the center of the fence edge and a level as shown in Fig. 5.

As seen in Fig. 3, the ripping fence (at left) is positioned by a clamp at each end, a clamp which is tightened by turning a knob somewhat similar to a wingnut. This arrangement is shown in Figs. 6 and 7. (Fig. 6 also shows the aluminum insert for the working face of the ripping fence.) It is obvious that the clamp on the underside of the table top is a simple right angle piece of strip steel with a hole drilled through it for the bolt. It is obvious in Fig. 7 that this clamp is free to turn about the bolt and can turn in such a way that only a small portion of the clamp is actually bearing on the table top.

The guard over the saw blade is shown in Fig. 8. It is obvious that the end of the guard is open. The rear end of the guard is attached to an extension bracket using a single bolt with nut as shown in Fig. 9. The bracket is attached to the splitter, again with a single bolt (Fig. 9). The splitter, in turn, is attached to a splitter bracket using two bolt/nuts (Fig. 10). This splitter bracket is attached with a single bolt and hand knob (thus providing some adjustment) to a splitter mounting bracket. This latter bracket is attached to the underside of the table top with two slotted pan head screws (#8 x 5/8). Figs. 11, 12, and 13 are excerpts from the owner's manual which provide greater insight into the guard/splitter/bracket assembly.

The above requires several component parts and some care in assembly. I note that the two bolt/nuts holding the splitter to the splitter bracket are not provided with washers or any kind of locking mechanism other than friction from tightening. The two single bolt/nuts at each end of the extension bracket must be tightened, but if they are tightened too much, then the bracket and guard can not move freely as a function of thickness of the piece being sawn. One might infer from Fig. 9 that the bolt/nut between the guard and extension bracket is tightened too much. This is not the case, but is due to the physical configuration of the assembly components. For example, with material 1 1/2 in. (3.8 cm) thick, the guard cocks up in front. In other words, the guard will not have its full length on the top of the workpiece but contacts the workpiece only on the rear corner. It is further noted that the maximum workpiece thickness is 1 7/8 in. (4.75 cm).

No antikickback device of any kind is seen in Fig. 3. Apparently none was supplied in the package. No comment of any kind was made in the owner's manual.

The portable saw is attached to a sawplate (center of the table top in Fig. 3). There is a large slot in the plate for the blade to come through. There is a notch at the front and rear ends of the plate through which the blade passes. [The notch at the rear is seen in Fig. 13 where it is used to hold the aligning tooth.] It is necessary for the assembler to align

the saw blade with these two notches while retracting the blade guard and centering (front to rear) the diameter of the blade in the slot. The saw soleplate is then clamped to the plate using four bolts (1/4-20 x 1 1/4 slotted flat head bolts) with hex nuts. The plate is then turned upside down so that the electric motor of the saw is underneath the table top. Even with good assembly, two problems exist. It is good practice to adjust blade height to just a little greater height than the thickness of the workpiece. This adjustment can be made but requires the operator to get down under the table to make the adjustment. This is both awkward and inconvenient. In addition, when assembly is complete, the blade guard rises up into the slot (Fig. 14) tending to place some upward force on the workpiece.

SAFETY INSTRUCTIONS

The owner's manual had a total of 24 pages, largely dealing with assembly of the table. Those statements in the manual which Hopper listed as safety precautions and instructions are:

- * Do not operate your saw table until you have completed assembly, installed your power tool according to instructions and read and understood this owner's manual in its entirety!
- * Read owner's manual of the power tool used with your saw table. Learn tool's application, its limitations as well as tool's potential hazards. Observe general safety rules of the use of power tools.
- * Read all specific safety precautions for your saw table as outlined throughout this booklet, before operating your saw table.
- * Do not use saw table in an unintended way.
- * Always disconnect plug from A.C. power outlet when tool is not in use or before making adjustments.
- * Keep children away. Never let a child operate saw table.
- * Check over your assembly. Make sure saw-table is properly put together. Check if fasteners are tight. (Periodically check fasteners to see that they did not loosen.) Special care must be taken to ensure that saw, router or sabre saw is securely mounted to sawplate; check soleplate clamps and fasteners for a positive grip.
- * When saw table is in the open position, set up for work, tubular leg locking braces must be securely engaged over locking bolts; support braces securely clamped to legs with knobs.
- * Always stand saw table on a sturdy and level floor. When working on

large work-pieces or with heavy materials saw table might tip over as you are pushing against the top. To increase the stability of the unit place some heavy weights, such as sand bags, over the front crossbraces.

- * Properly ground all power tools except if they are double insulated.

NOTE: The electrical box on your saw table is designed for 15 amps.
DO NOT EXCEED!

- * Wrap loose power cords together to prevent them from getting caught in the moving parts of the power tool. Be careful. Do not trip over cord!

- * Guard hood must be in place at all times. Also make sure guard hood and splitter are properly aligned.

- * Wear proper clothing. Do not wear loose clothing or jewelry that may get caught in moving parts.

- * Protect your eyes. Wear safety glasses or goggles. Use a dust mask under dusty conditions.

Before testing your saw table's operation please follow these additional safety precautions and general operations procedures and rules.

- * Avoid getting your hands too close to the blade or the cutting bit. Use the miter gauge or a push stick whenever possible.

- * Always hold work securely and follow the recommended procedures, for a safer operation.

- * Do not overreach. Avoid an awkward position.

- * Always feed work into the cutting tool against the direction of rotation. Stop power tool immediately if a problem develops. Do not force tool.

- * Wide work pieces must be supported to avoid an awkward operation. Also make sure saw table is weighted down to provide maximum stability.

- * Never reach under saw table when power is on. Disconnect power before making any adjustments.

- * Never leave saw table unattended when power is on.

OPINION

Although the failure to provide a trigger lock appeared to have no bearing on Mr. Barton's injury, the failure to include a trigger lock, or even suggest something in the manual, is a fault on the part of Hopper. In addition, even if the "safety shut-off bar" were used in an emergency situation, it would still take several seconds for the saw to come to a stop. A braking device, working from an interlock, would be highly desirable. The "safety" terminology used by Hopper could be misleading for the table user.

The fact that the table top is not flat is clearly a defect. It is not known, nor is it obvious, why the table top was not flat. It might have been subjected to a heavy load for an extended period and/or affected by moisture. If the table top had been made from steel sheet [1/8 in. (32 mm) thick] with two grooves (for the miter) and edges formed into "lips", the resistance to bending would have been increased by a factor of approximately 7 with an increase of about 33% in weight.

The fact that the working face of the ripping fence is not straight is another defect. While the departure from straightness appears small, it is significant enough to potentially cause binding in ripping relatively narrow pieces. Hopper should have straightened the T-shaped aluminum extrusion and inserted it in the fiberboard portion of the fence.

The arrangement for clamping the ripping fence is a serious defect. It is essential that the edge of the fence be parallel to the saw blade. To hold the right angle clamp, to maintain the desired distance between the fence, and to turn the knob (i.e., three operations) is difficult to perform with two hands. And this must be done at both ends of the fence. This suggests a rather high probability of misalignment despite the best efforts of the operator. This problem could have been eliminated by putting a small tab on the edge of the clamp bearing against the fence and drilling a small hole into which this tab would fit. This would allow some motion while providing adequate clamping surface against the underside of the table top.

The failure to provide a barrier at the front end of the hood guard over the saw blade is a defect in terms of ANSI 01.1 (See Appendix). This standard says that hood-type guards should "protect the operator from" flying splinters and broken saw teeth." This clearly implies a closure at the front end of the guard. The failure of the hood guard to automatically adjust to the thickness of the work piece (because of its physical configuration) is also a violation of ANSI 01.1. With no precise instruction in the owner's manual (see Fig. 12) on how tight the two bolts should be, it is quite likely that the bolts will be overtightened and the hood guard will not properly adjust to the workpiece thickness.

The combination of splitter, splitter bracket, and splitter mounting bracket is defective. As designed, two bolts with square nuts are used to hold the splitter and splitter bracket together. One problem with these square nuts is that their thickness is just about the length required by three turns on the thread. With these specific bolts, this thickness is much less than the 3/4 diameter minimum nut thickness normally recommended in published literature, of which there is an abundance. Perhaps even more

important, there is no locking of any sort used with these bolts. Although "lock washers" are not very effective, use of them would certainly have been an improvement. There are a number of locking nuts, e.g., fiber or plastic inserts, available on the market. [It might be noted that the acorn nut used in Fig. 12 is simply crimped metal and not one of the "good" locking nuts.] In addition, there is no indication of how "tight" these should be nor any warning to periodically check and retighten (Fig. 11). It seems highly probable that vibration might occur, especially during cutting, leading to loosening of the nuts. There is no indication of this probability or its potential effects in the owner's manual. I ran the saw three or four times and noticed some vibration even though I made no attempt to cut any material.

If, however, Hopper had used two pieces rather than three, the bolt/nut problem would have been eliminated. The splitter and splitter bracket could be formed in one piece. This piece could be attached to the splitter mounting bracket (as done in the original design), thus still providing needed adjustability.

Failure to provide an antikickback device is another defect in violation of ANSI 01.1.

The fact that the blade guard on the portable saw comes up through the blade slot may not be a major problem, but there is no question that it does require imposition of force through the workpiece to deflect the guard enough that the workpiece will "ride" smoothly on the table top.

With regard to safety instructions provided in the owner's manual, I believe these are not adequate. Much of the wording is vague or not definitive. There are several examples of this, e.g., "check if fasteners are tight. (Periodically check fasteners to see that they did not loosen.)" This raises questions as to (1) what does "tight" mean, (2) how often is "periodically", and (3) just what is meant by "check?" In addition, these and all instructions were only in the owner's manual. The individual assembling the table would undoubtedly read them. There is no certainty that any other user would ever know of their availability, let alone read them. There were no directions or warnings on the assembled saw table although Hopper's designation of "saw table" is prominent (Fig. 3).

It is my opinion that this saw table was NOT suitable for the intended purpose. There are a number of design defects, a few defects which might be considered manufacturing defects rather than design defects, and a set of safety statements which is NOT adequate. An additional defect is the complete absence of any directions or warnings on the saw table. Two defects which I would definitely consider design defects (open ended hood guard and lack of an antikickback device) are also clear violations of ANSI 01.1 and OSHA, Part 1910. It may be that Hopper will contend that it was producing a saw table, not a table saw. This argument is specious and fallacious. Hopper's intention is that the purchaser will mount his own portable circular saw on the table so that the combination will function as a table saw. ANSI 01.1 and OSHA, Part 1910 should thus apply.

As to the credibility of Mr. Barton's story, I conclude it is believable. Assuming good alignment of the saw blade with the splitter, it

is highly believable that the fence was not properly parallel with the saw blade. This might lead to binding. In addition, the lack of flatness of the table top and the lack of straightness of the ripping fence might also lead to binding. The piece of wood being ripped was relatively light and probably not heavy enough to depress the blade guard. If there were binding, the workpiece would tend to kick back. The lack of an antikickback device would create a hazard for the operator. It is understandable that Mr. Barton was exasperated on the third unsuccessful try to rip the length of the board. I believe he knew that he should use a "push stick", and normally did, but apparently thought there might be some problem with the hood guard. He apparently used the heel of his hand to try to raise the hood guard slightly because he was using his fingers to provide protection from potential flying chips or splinters since there was an open end on the hood guard. The force he applied apparently was directed upward and sufficiently to the right to push the splitter and attached hood guard off the table. Even though the saw had only been operated for some 6 to 8 hours in 6 months since assembly, it appears there was enough vibration to loosen the nuts on the bolts between the splitter and the splitter bracket.

In summary, it is my opinion that this saw table was not suitable for the intended purpose and that Mr. Barton quite likely was injured in essentially the manner he alleges.

If you have further questions, or need clarification of any of the above material, I will be glad to elaborate.

Sincerely,

Michael Faber

[I also added a "stick it" with the comment: "Bob, I think this whole thing is schlock!"]

APPENDIX

Excerpts from AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) 10.1-1975

"Safety Requirements for Woodworking Machinery"

- a) Section 6.1.2.1 Each circular hand-fed rip saw shall be provided with a hood-type guard that will cover the blade at all times when the blade is not in use. This may be accomplished by the use of a guard that will automatically adjust to the thickness of the material being cut, or by a fixed or manually adjusted guard. If a fixed or manually adjusted guard is used, the space between the bottom of the guard and the material being cut shall not exceed $3/8$ " if $1-1/2$ inches or more from the blade, and $1/4$ inch if closer than $1-1/2$ inches.

- b) Section 6.1.2.3 Hood-type guards shall be so designed and constructed as to resist blows and strains incidental to reasonable operation, adjusting, and handling, in order to protect the operator from flying splinters and broken saw teeth.
- c) Section 6.1.2.4 The hood shall be so mounted as to ensure that its operation will be positive, reliable, and in alignment with the saw. The mounting shall be adequate to resist any reasonable side thrust or other force that would disrupt alignment.
- d) Section 6.1.2.6 A push stick shall be used on short or narrow stock when there is a possibility of the hand contacting the cutting tool.
- e) Section 6.1.2.7 Each hand-fed circular rip saw shall be equipped with a spreader to minimize the possibility of material squeezing the saw or of material kickbacks. The spreader shall be made of tempered steel, or its equivalent, and shall be slightly thinner than the saw kerf. It shall be of sufficient width to provide adequate stiffness or rigidity to resist any reasonable side thrust or blow tending to bend or throw it out of position. The spreader shall be attached so that it will remain in true alignment with the blade, even when either the saw or table is tilted, and should be placed so that there is not more than 1/2 inch space between the spreader and the back of the blade when the recommended saw blade is in its maximum "up" position. If a blade smaller than the maximum permissible size is used, the spreader shall be moved to within 1/2 inch of the blade. The provision of a spreader in connection with grooving, dadoing, or rabbeting is not required. On the completion of such operations, the spreader shall be immediately replaced.
- f) Section 6.1.2.8 Each hand-fed circular rip saw shall be provided with antikickback devices so located as to oppose the thrust or tendency of the saw blade to pick up the material or throw it back toward the operator. These devices shall be designed to provide holding power for all the thicknesses of material being cut.
- g) Section 6.14 Other Machines Not Excluded. The mention of specific machines in 6.1 through 6.12 inclusive, is not intended to exclude other woodworking machines from the requirement that suitable guards and exhaust hoods be provided. Reduce to a minimum the hazard due to the point of operation of such machines.

It should be noted that the Occupational Safety and Health Act (OSHA) Part 1910, Title 29 of the Federal Register, 1971, conveys an almost identical message in only slightly different phrasing.

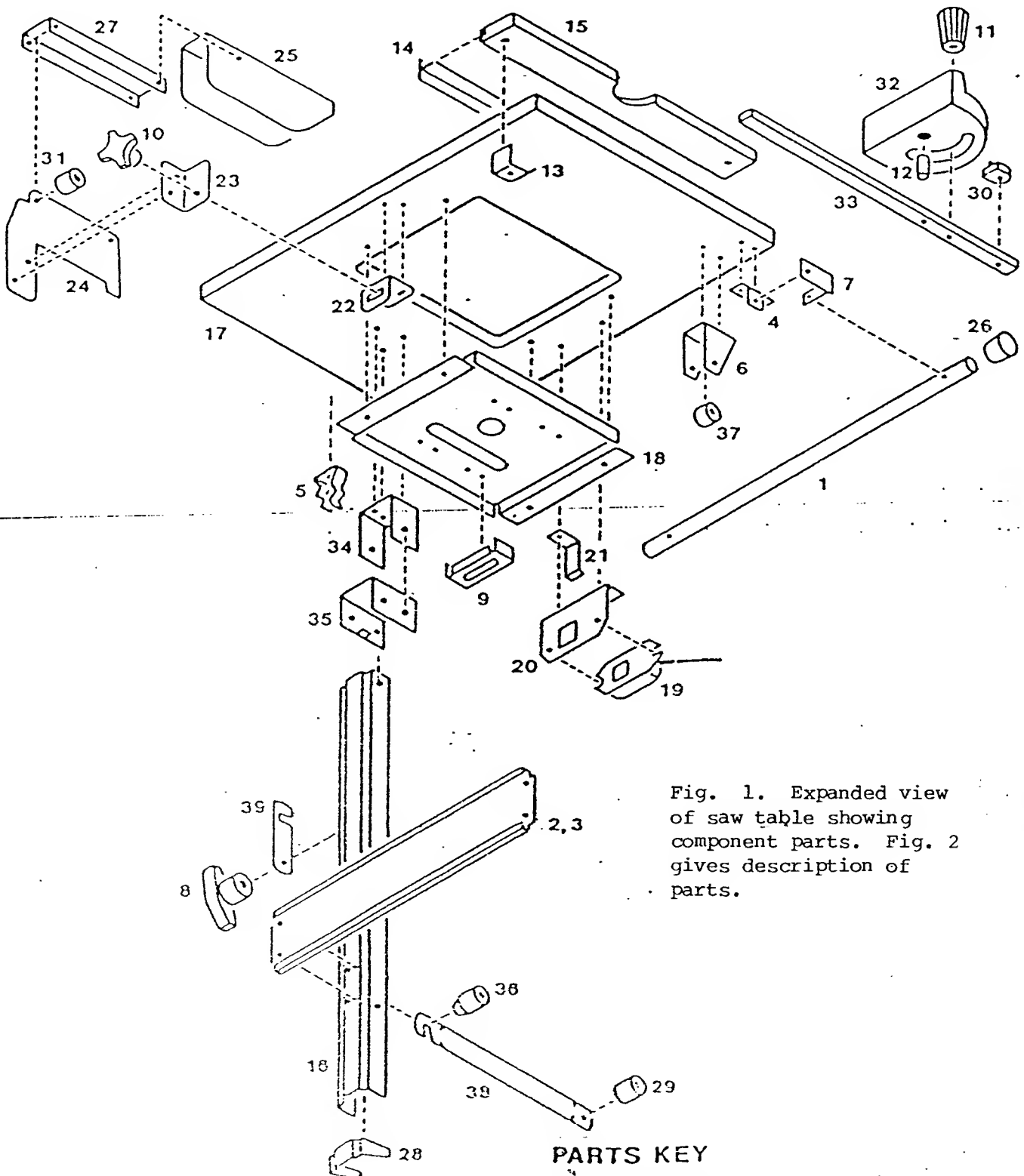


Fig. 1. Expanded view of saw table showing component parts. Fig. 2 gives description of parts.

PARTS KEY

(SEE OPPOSITE PAGE FOR DESCRIPTION)

PART KEY	PART No.	PART DESCRIPTION	QUANTITY	PART KEY	PART No.	PART DESCRIPTION	QUANTITY
		<u>HARDWARE BAG No. 1 (6E381)</u>				<u>HARDWARE BAG No. 7 (6E387)</u>	
4.	81064	#8x5/8" SLOTTED PAN HEAD SCREW -----	20 ()		81149	10-24x1-3/4" SLOTTED PAN HEAD BOLT ---	2 ()
5.	7F612A	SHUT OFF BAR MOUNTING BRACKET -----	2 ()		81078	10-24 ACORN NUT -----	2 ()
6.	8X609	RETAINER CLIP -----	2 ()		81098	10-24x1/2" CARRIAGE BOLT -----	1 ()
	7F222	SUPPORT BRACKET -----	2 ()	10.	8K495	10-24 KNOB -----	1 ()
	81045	10-24x3/8" SLOTTED TRUSS HEAD BOLT --	2 ()		81260	1/4-20x3/8" SLOTTED ROUND HEAD BOLT --	1 ()
	81247	10-24 HEX LOCK NUT -----	2 ()				
		<u>HARDWARE BAG No. 2 (6E382)</u>				<u>HARDWARE BAG No. 8 (6E388)</u>	
7.	81051	10-24x1-1/8" SLOTTED PAN HEAD BOLT --	2 ()		81151	1/4-20x1-1/4" HEX HEAD BOLT -----	1 ()
	81078	10-24 ACORN NUT -----	2 ()	11.	8K541	MITER GAUGE HANDLE -----	1 ()
	7F611A	SHUT OFF BAR HINGE -----	2 ()		81259	LARGE FLAT WASHER -----	1 ()
	81094	10-24x3/8" SLOTTED PAN HEAD BOLT -----	2 ()	12.	8X078	7/8" PIVOT ROD -----	1 ()
	81247	10-24 HEX LOCK NUT -----	2 ()		81247	1/4-20x2" CARRIAGE BOLT -----	2 ()
	81202	1/4" I.D. FLAT WASHER -----	2 ()	13.	7F802	FENCE CLAMP -----	2 ()
	81065	10-24x9/16" SLOTTED ROUND HEAD BOLT -	2 ()		8K469	1/4-20 RECTANGULAR KNOB -----	2 ()
		<u>HARDWARE BAG No. 3 (6E383)</u>				<u>UNIT PACKED PARTS</u>	
	81046	10-24x3/8" SQUARE NUT -----	10 ()	1.	6N215	SHUT OFF BAR -----	1 ()
	8K525	RECESSED BUMPER -----	2 ()	2.	6N216	FRONT CROSS BRACE (w/label) -----	1 ()
	81094	10-24x3/8" SLOTTED PAN HEAD BOLT -----	8 ()	3.	72134	REAR CROSS BRACE -----	1 ()
	81247	10-24 HEX LOCK NUT -----	8 ()	14.	8X260	"T" HOLDING -----	1 ()
	81045	10-24x3/8" SLOTTED TRUSS HEAD BOLT --	8 ()	15.	71290	RIP FENCE -----	2 ()
		<u>HARDWARE BAG No. 4 (6E384)</u>		16.	7F806	LEG -----	4 ()
	81104	1/4-20x2-1/4" HEX HEAD BOLT -----	4 ()	17.	71291	SAW TABLE TOP -----	1 ()
	81165	1/4-20 ACORN NUT -----	4 ()	18.	8X262	SAW PLATE -----	1 ()
	81216	10-24x1-1/4" SLOTTED ROUND HEAD BOLT	2 ()	19.	8X261	ELECTRICAL OUTLET / SWITCH BOX -----	1 ()
	81078	10-24 ACORN NUT -----	2 ()	20.	7F618A	ELECTRICAL OUTLET MOUNTING BRACKET --	1 ()
	81164	1/4-20x2-1/2" HEX HEAD BOLT -----	2 ()	21.	7F614	SHUT OFF BAR SPRING -----	1 ()
	81212	1/4-20 SQUARE NUT -----	4 ()	22.	7F610A	SPLITTER MOUNTING BRACKET -----	1 ()
1.	8K469	1/4-20 RECTANGULAR KNOB -----	2 ()	23.	7F613A	SPLITTER BRACKET -----	1 ()
		<u>HARDWARE BAG No. 5 (6E385)</u>		24.	7F617A	SPLITTER -----	1 ()
	81009	1/4-20x5/8" SLOTTED TRUSS HEAD BOLT -	2 ()	25.	8K538	GUARD HOOD -----	1 ()
	81165	1/4-20 ACORN NUT -----	2 ()	26.	8K543	SHUT OFF BAR END CAP -----	2 ()
	81202	1/4" I.D. FLAT WASHER -----	6 ()	27.	7F615A	GUARD HOOD EXTENSION BRACKET -----	1 ()
	81253	1/4-20x1-1/4" SLOTTED FLAT HEAD BOLT	4 ()	28.	8K532	BOTTOM CAPS AND LONG SPACERS -----	4 ea. ()
	81144	1/4-20 HEX NUT -----	4 ()	29.			
9.	7F616	SOLE PLATE CLAMP -----	4 ()	30.	8K540	DEGREE POINTER -- 1 () ORANGE SPACER --	2 ()
		<u>HARDWARE BAG No. 6 (6E386)</u>		31.			
	81089	10-24x1" SLOTTED FLAT HEAD BOLT -----	4 ()	32.	8K539	MITER GAUGE -----	1 ()
	81208	#10 SPLIT LOCK WASHER -----	4 ()	33.	7F237A	MITER GAUGE BAR -----	1 ()
	81229	10-24 HEX NUT -----	4 ()	34.	7F803	HINGE BRACKET -----	2 ()
	81045	10-24x3/8" SLOTTED TRUSS HEAD BOLT --	2 ()	35.	72133	LEG MOUNTING BRACKET -----	2 ()
	81046	10-24x3/8 SQUARE NUT -----	2 ()	36.	8K524	BEVELED AND SHORT SPACERS -----	4 ea. ()
	81261	1/8"x1-1/8" FOLL PIN -----	1 ()	37.			
				38.	72130	TUBULAR BRACE -----	4 ()
				39.	7F801	LEG LOCKING BRACKET -----	2 ()

PARTS CHECKLIST & DESCRIPTION

QUANTITIES NECESSARY FOR ASSEMBLY

Fig. 2. Description of component parts shown in Fig. 1.



Fig. 3 Overall view of assembled saw table without a circular saw mounted on it.



Fig. 4 View of section of table top showing a separation between it and a level [24 in (61cm) long]. Although not obvious on the vertical scale, this separation is about $3/16$ in (48 mm).

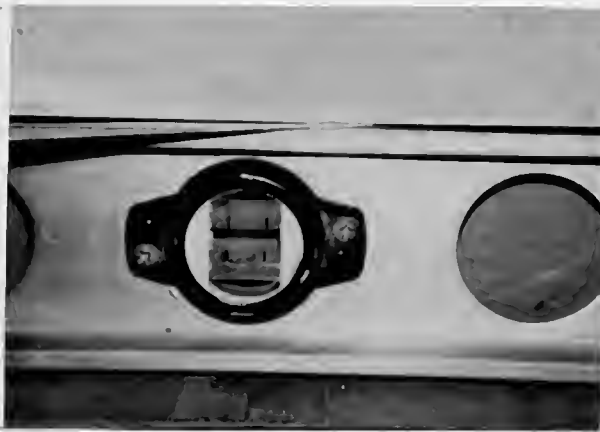


Fig. 5 View of ripping fence and level (below) showing that the working edge of the ripping fence is not straight. A 6 in (0.15 m) scale [0.032 in (8.1 mm) thick] at left is "sloppy" in the gap of about $\frac{3}{64}$ in (12 mm).



Fig. 6 Clamp used to hold ripping fence in position on table top. The extruded aluminum insert used for a working face can be seen in the left edge of the fence cross-section.



Fig. 7 Different view of clamp used to hold ripping fence in position on table top. It is obvious that little of the clamp is in contact with the underside of the table top.



Fig. 8 Clear plastic guard for use above, and surrounding, the saw blade. Note that the left end (facing the operator) is open.

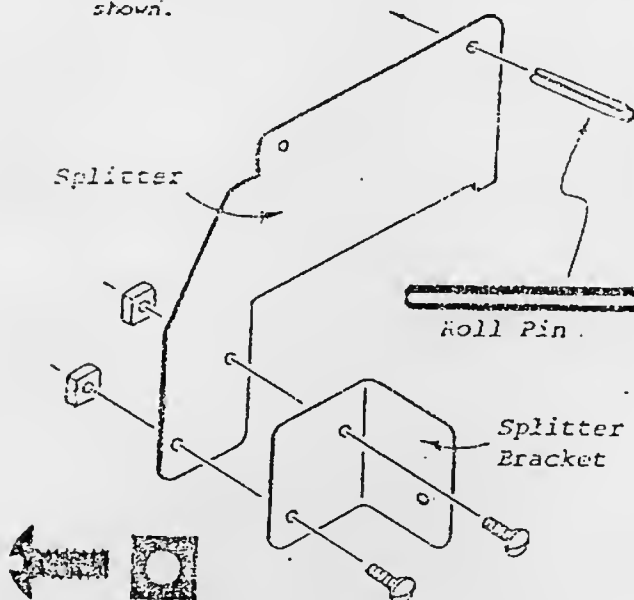


Fig. 9 Rear end of (hood) blade guard showing attachment by a single bolt/nut to an extension bracket which, in turn, is attached to the splitter. The extension bracket is shown at maximum elevation. Note that the guard would touch the workpiece only at the back corner in this configuration.



Fig. 10 Attachment of guard/splitter assembly to the table top. The single bolt/nut, between the extension bracket and splitter is at the upper center. The two bolt/nuts between the splitter and splitter bracket are at left center. The hand knob (for adjustment) is shown holding the splitter bracket to the splitter mounting bracket.

- Force roll pin, half way, thru splitter using end hole in the upper corner. Note: roll pin must be centered in splitter so that equal lengths of the roll pin extend out on each side of the splitter. This will enable guard hood to be centered over sawblade; see Step 16.
- Attach splitter bracket to the splitter using two bolts and nuts. Position as shown.



Use this 10-24x3/8" Slotted Truss Head Bolt, 10-24 Sq. Nut and 1-1/8" Roll Pin Hardware Bag No. 6.

Fig. 11 Excerpt from owner's manual showing instructions and method of assembly of splitter and splitter bracket.

- Place guard hood extension bracket over the splitter, then place an orange spacer on both sides of the splitter inside the extension bracket. See illustration.
- Insert a long bolt thru extension bracket, thru spacers and thru splitter and secure with an acorn nut.
- Now attach guard hood to the extension bracket, as shown using the long bolt and acorn nut. Do not overtighten !

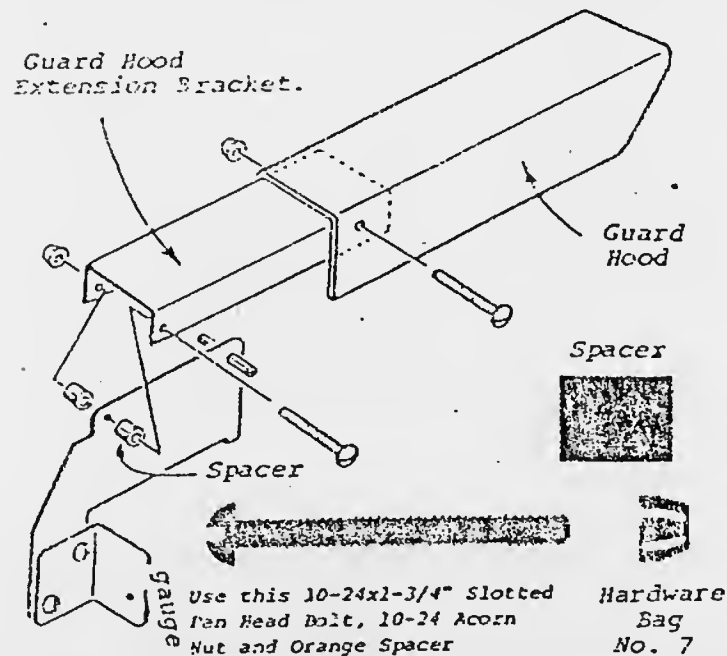
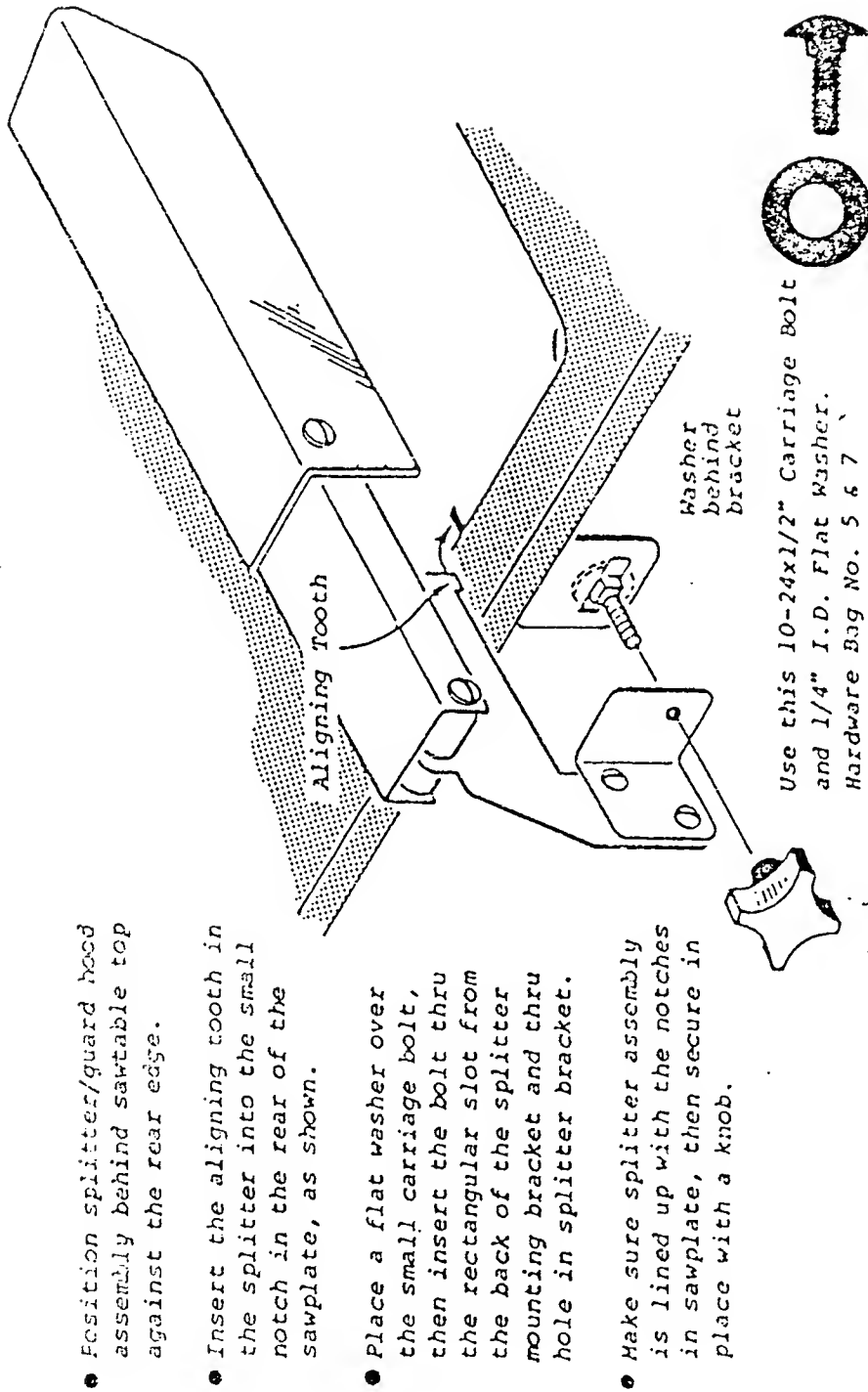


Fig. 12 Excerpt from owner's manual showing instructions and method of assembly of guard, extension bracket, and splitter.



Fig. 14 View of saw blade in operating position. Note that the blade guard, an integral part of the portable saw, also extends upward through the slot provided for the blade.



- Position splitter/guard hood assembly behind sawtable top against the rear edge.
- Insert the aligning tooth in the splitter into the small notch in the rear of the sawplate, as shown.
- Place a flat washer over the small carriage bolt, then insert the bolt thru the rectangular slot from the back of the splitter mounting bracket and thru hole in splitter bracket.
- Make sure splitter assembly is lined up with the notches in sawplate, then secure in place with a knob.

Fig. 13 Excerpt from owner's manual showing instructions and assembly of guard/splitter/bracket assembly to the table top.

SAW TABLE OR TABLE SAW? PART C

A major part of preparation for trial occurs during the "discovery" process. All attorneys legally have access to all information developed by all parties except other attorneys' files. For plaintiff's attorney, in particular, this means access to the manufacturer's files, although the requesting attorney must be relative specific about what is wanted. The information must also be pertinent to the matter in hand.

In the case of Barton vs Hopper, this means that the attorney for Hopper can depose me, Mike Faber, require me to make my written report available (usually at time of deposition), and ask for any other information which I may have in my file. It is common practice for the attorney taking the deposition to ask to see the witness' file. Mr. Gumshoe, attorney for Hopper did depose me. He asked me questions about my examination, what I found that I alleged to be defects, and my interpretation and conclusions. He did not, however, ask to see my file - nor did he ask if there were a written report. My deposition (62 pages of transcript) set forth pretty much the same views as expressed in my report to Bob Stratton.

Bob Stratton, in turn, deposed Mr. Martin Hubris, President and CEO of Hopper. His first deposition had a transcript of 152 pages. His deposition was continued about a month later with a transcript of an additional 31 pages. A summary of the most pertinent testimony is follows.

Mr. Hubris attended a well-known educational institution from which he received a bachelor's degree in Industrial Engineering in 1950. Three years after graduation, he started working for Hopper and became President about 25 years later.

Hopper Corporation had traditionally produced "shelving", i.e., manufacturing shelves, drawer units, workbenches, etc., for both home and industrial use. Hopper was wholly owned by one individual who served as chairman of the board. This individual gave full responsibility for all phases of company operation to Mr. Hubris in the role of President and CEO. In that role, he had the final responsibility for all operations of the company although others had day-to-day responsibility for all aspects except product development. Mr. Hubris was directly responsible for this activity which took 15 to 25% of his time. Mr. Hubris was not a Registered Professional Engineer nor was he a member of any engineering association such as AIIE or ASME. In addition, he did not regard himself as a safety expert. Nonetheless, he designed the saw table in question and took full responsibility for all aspects of the design.

Development of the concept of a free standing saw table for use with any other manufacturer's saw started early in 1979. The saw table was put on the market about the middle of 1980. The anticipated market was the general public, i.e., the "do it yourselfer." At the time of initial production, Hopper's selling price was about \$30 with a suggested retail price of \$50.

Mr. Hubris said he was the only engineer involved in the design and development of the saw table. Hopper employed no product safety engineers nor did it employ outside consultants for advice on any aspect of the saw

table. The owner's manual, including all assembly instructions and safety precautions, was prepared within Hopper. Mr. Hubris reviewed and edited this manual. At no time was there any consultation with any individual expert or organization (e.g., Underwriters Laboratory) outside Hopper.

Mr. Hubris was aware there were ANSI and OSHA standards relative to power tools, and to table saws in particular, but he did not regard them as pertinent since he was designing a saw table. He was aware of the need for guarding the saw blade. No closure was put on the front end (to prevent flying splinters), although he was aware of such a requirement by ANSI and OSHA. He admitted he designed the guard knowing it was not in compliance with ANSI and OSHA, as he did not believe these standards applied to his saw table.

Although he admitted that antikickback devices are a safety feature (and required by ANSI and OSHA), they were omitted to make it easier for the user to follow a straight line when ripping material.

No devices were included that would prevent operation of the saw in the event that the hood guard was not in place. He was not aware of any such devices nor was he aware of interlocks. No consideration was ever given to such a device.

It was assumed that the principal market for the product would be the general public, the "do-it-yourselfer." The table was packaged in a "knock down" condition in order to sell at a "minimum" price. In this context, Mr. Hubris agreed that it was incumbent on Hopper to make a product which was reasonably safe. He did not think it likely that a user would use the saw table in imprudent ways and thus Hopper had no obligation to design for protection of one who might possibly use the product in imprudent ways. Mr. Hubris also believed that every user of the saw table would have read the owner's manual. He did not see how one could properly assemble the table without reading the manual. He did admit there might be other users in addition to the assembler but also admitted that no action was taken to try to inform such users. There was simply the assumption that the owner's manual would be available and would be read by all users.

When asked about testing of the product before putting it on the market, Mr. Hubris indicated that the only testing was done by him using a prototype table. He was doing a specific renovation project at home and used the table throughout this project, involving cutting thin materials, thick materials, soft wood, plywood, and cross cuts. No testing of any kind, other than this personal use test, was performed. He did admit that he observed some vibration but he did not consider this a safety problem. He further said he did not consider it foreseeable the "typical vibration" could cause nuts to loosen on bolts.

SAW TABLE OR TABLE SAW? PART D

RESOLUTION

About 6 1/2 years after the saw table went on the market, about 6 years after Ed Barton purchased and assembled it, and about 5 1/2 years after the injury, Ed Barton was given \$350,000 as the result of an out of court settlement.

COMMENTS (by C.O. Smith)

One might agree that the objective, i.e., put a useful, versatile tool on the market for use by the general public, is reasonable and even laudable. I conclude, however, that execution of the design and development process was sadly lacking and failed to apply well known principles, thus resulting in an inferior product. Mr. Hubris' argument that ANSI and OSHA standards for table saws did not apply to his saw table seems ridiculous. Once a portable circular saw is mounted on the saw table, the combination effectively becomes a table saw, as is obvious from the intent of the design.

The failure to consult experts in design and safety during the design and development process, or to have a prototype reviewed certainly is counter to good engineering practice. One would hope that a product intended to be used by the general public, having a wide spectrum of understanding of products and concern for safe usage, would be tested under much more extensive and rigorous conditions than was the case with this saw table. There also seems to be a significant lack of understanding of "foreseeability" as the US Courts use the term in products liability litigation.

This situation appears to be summarized by Allaway [1] who said: "I find that progress is hardly ever limited by the need for new knowledge but nearly always by the failure to make effective use of existing knowledge."

One might, however, prefer a view from Ben Franklin [2]: "A little neglect may breed great mischief --- for want of a nail the shoe was lost; for want of a shoe the horse was lost; for want of a horse the rider was lost; for want of a rider the battle was lost; and for want of a battle the kingdom was lost."

1. Allaway, P. A., "Opening Address", Third National Reliability Conference, Institute of Quality Assurance, United Kingdom, April 1981
2. Franklin Benjamin, Poor Richard's Almanac, 1758

SAW TABLE OR TABLE SAW?

INSTRUCTOR'S NOTE

This instructor's note is intended for the purpose of suggesting possible avenues of questioning (verbal or written) which might be used with a class. The note may be useful in stimulating the instructor's thoughts of additional aspects or emphases which might be considered desirable.

PART A:

If the student plays the role of Mike Faber, what additional questions should be asked of Bob Stratton?

What information is missing?

What course of action should Mike Faber take? (In some detail)

If the student were to design such a table, what kinds of things should be considered? Perhaps a conceptual solution, with sketches and key aspects, might be appropriate.

PART B:

What comments would students make on the quality of writing in the owner's manual? If adverse, how would they rewrite?

What comments would students make on the appropriateness of the safety instructions? If there is disapproval, how should these instructions be written?

Assuming Faber's observations are correct, students might be asked to constructively criticize Faber's report to Stratton. In the context of constructive criticism, for example, students might be asked to make a thorough analysis of the bolting procedures used by the manufacturer. Reference could be made to such basic mechanical design texts as:

Shigley & Mitchell, "Mechanical Engineering Design", 4th Ed., McGraw-Hill, 1983

Juvinall, "Fundamentals of Machine Component Design", Wiley, 1983

Black & Adams, "Machine Design", 3rd Ed., McGraw-Hill, 1968

Spotts, "Design of Machine Elements", 6th Ed., Prentice-Hall, 1985

Deutschman, Michels & Wilson, "Machine Design", Macmillan, 1975

Burr, "Mechanical Analysis and Design", Elsevier, 1981

Hindhede, Zimmerman, Hopkins, Erisman, Hull and Lang, "Machine Design Fundamentals", Wiley, 1983

Reference might also be made to: Smith & Radavich, "If You Bolt, Be Careful!", ASME Pamphlet Paper 86-DE-2

Haviland, "Designing With Threaded Fasteners", Mechanical Engineering, October 1983, pp 17-31

Bickford, "Introduction to the Design and Behavior of Bolted Joints", Marcel Dekker, 1981

What are the relative merits of various methods of locking bolt/nut combinations? Should some of these have been used in this design? If so, in only some places or throughout? Why? Why not?

Students might be asked to take a careful look at the 3-piece arrangement of the splitter/splitter bracket/mounting bracket in comparison with a 2-piece arrangement in which the splitter and splitter bracket are one integral piece. What would this mean in terms of effectiveness of "security" of the mounting? What would this mean in terms of manufacturing and relative cost?

Does the fact that the clear plastic blade guard does not fully contact the workpiece under all working conditions violate ANSI (and OSHA) standards?

What is the reaction to the absence of an anti-kickback device? Should one be on the table? If so, what sort of design or configuration?

What aspects, if any, of the design violate ANSI (or OSHA) standards?

Since the manufacturer designed a saw table (not a table saw), do standards (such as ANSI) for a table saw apply to this design? Why? Why not?

How would students design such a saw table? (Perhaps viewed as an expansion and clarification of the conceptual design in Part A.)

Do students believe the effect of the blade guard (on the portable circular saw) protruding up through the slot for the saw blade is on any significance? Why? Why not?

Why would Mike Faber put his "schlock" comment on a "stick it" or "post it" rather than put it in the body of his report to Bob Stratton?

PART C:

What are the reactions to Hubris' testimony in his deposition? Do the students think he was sufficiently knowledgeable to design this saw table? If not, what should have been done?

Students might be asked to constructively criticize Hubris' comments.

What do students think Hubris meant by "imprudent use"? What do the students think is "imprudent use"? Do students think it reasonable to rely on purchasers/owners/users to be "prudent" in the use of a saw table (or table saw)? What things might the user do, whether "prudent" or not, i.e., what actions might be taken that are foreseeable?

Would some vibration be expected during operation of this saw table with a portable circular saw mounted on it? If so, is there an expectation that this might loosen nuts? Why? Why not? What action, if any, should be taken in this matter?

PART D:

What are the reactions to the settlement?

Given that Bob Stratton will get 20 to 35% of the settlement after deducting all expenses (including Mike Faber's charge), would it be

possible for Ed Barton to invest the remaining sum in such a way that he could live "moderately" for the rest of his life?

Recognize that Ed Barton has very limited use of his left hand (only the thumb is really functional) and doesn't seem to be able to adjust to doing clerical or other work (despite having made some effort). Assuming that he, and his family, should be able to manage on the income from a judicious investment, is it reasonable that he should be "taken care of" in this manner for the rest of his life?

Should Bob Stratton assist Ed Barton in making a judicious investment, either directly or by recommending a good investment counselor? Is such action expected of an attorney retained as was Stratton? [Such assistance is not part of the normal duties of the lawyer but Stratton did assist by recommending an investment counselor.]